

REMARKS

Reconsideration and allowance of the above-identified application are respectfully requested.

Claims 47-121 are pending, wherein claims 57-60 and 91-117 are withdrawn from consideration, and claims 47-51, 53-56, 61-90 and 118-121 are under consideration. Of the claims under consideration, claims 47, 61-63 and 119-121 are independent. Claims 47 and 62 have been amended, and claims 118-121 have been added. No new matter has been added by these amendments.

Applicants note with appreciation the Patent Office's acknowledgement of the references submitted to the Patent Office in the Information Disclosure Statement (IDS) filed August 13, 2001.

However, it is respectfully noted that a Corrected Form PTO-1449 was submitted to the Patent Office on October 15, 2001, in which the document number of the first foreign (i.e., Japanese) document listed in the August 13, 2001 IDS was changed from "2-21744" to "5-21744." All other references listed in the original and corrected Form PTO-1449 are the same. Applicants respectfully request that the Patent Office acknowledge the corrected, first foreign document (i.e., Japanese document no. 5-21744) listed in the corrected Form PTO-1449 of October 15, 2001, as all other documents listed in the corrected Form PTO-1449 have been acknowledged by the Patent Office.

A copy of the October 15, 2001 corrected Form PTO-1449 is enclosed for the convenience of the Patent Office.

Applicants respectfully note that the present application is a U.S. national stage application filed in accordance with 35 U.S.C. § 371 of International Application No. PCT/JP99/04145, which has an international filing date of August 2, 1999. The international application properly claims priority to the following priority applications: Japanese Patent Application Nos. 10/219183,

10/219184 and 10/219187, each filed on August 3, 1998. In the present national stage application, in addition to the right of priority to which Applicants are entitled under 35 U.S.C. § 365, the present national stage application includes a claim for priority under 35 U.S.C. § 119(a) to the same Japanese priority applications. According to M.P.E.P. § 1893.03(c), "[i]f the 35 U.S.C. 119(a) and 35 U.S.C. 365(b) priority claim is to an application, the priority of which was properly claimed in the international application, the claim for priority is acknowledged" Since the priority applications were properly claimed in the international application, it is respectfully requested that the Patent Office acknowledge the aforementioned claim for foreign priority.

Applicants note with appreciation the Patent Office's reminder that the substance of the interview conducted with the Examiner on December 12, 2002, and the subsequent interview conducted with the Examiner's supervisor, John Niebling, must be made of record. Applicants respectfully note that an Interview Summary form of the December 12, 2002 interview with the Examiner was prepared by the Examiner, a copy of which was included with the present Office Action. According to M.P.E.P. § 713.04,

[i]t should be noted, however, that the Interview Summary form will not be considered a complete and proper recollection of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

The complete and proper recollection of the substance of any interview should include at least the following applicable items:

- (A) a brief description of the nature of any exhibit shown or any demonstration conducted;
- (B) identification of the claims discussed;
- (C) identification of specific prior art discussed;

(D) identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary form completed by the examiner;

(E) the general thrust of the principal arguments of the applicant and the examiner should also be identified, even where the interview is initiated by the examiner. The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner;

(F) a general indication of any other pertinent matters discussed;

(G) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary form completed by the examiner; and

(H) in the case of an interview via electronic mail, a paper copy of the Internet e-mail contents MUST be made and placed in the patent application file as required by the Federal Records Act in the same manner as an Examiner Interview Summary Form, PTOL 413, is entered.

Reviewing the Interview Summary in light of the aforementioned requirements of M.P.E.P. § 713.04, it is respectfully submitted that Item (A) is inapplicable, as no exhibit was shown or demonstration conducted during the interview with the Examiner. Regarding Item (B), claims 47-94 were generally discussed. Regarding Item (C), no specific prior art was discussed. The Applicants conducted an interview with the Examiner to request that the Examiner identify the claims readable on each species in accordance with the Requirement for Election of Species mailed August 27, 2002 (Paper No. 10). Although claims 47-94 had been elected prior to the interview, it was unknown to Applicants which claims were readable on the various species discussed by the Examiner in the Requirement for Election of Species. Thus, no specific prior art was discussed during the interview.

Regarding Item (D), no proposed amendments of a substantive nature were discussed during the interview, as the Applicants conducted the interview merely to request that the Examiner identify

the claims readable on each species. Regarding Item (E), the general thrust of the Applicants' argument is as indicated in the Interview Summary – "Applicants want examiner to identify the species." [see Interview Summary] The Examiner's response was a refusal to give Applicants a complete indication of the claims readable on each species, and indicated that Applicants would have to respond by a renewed Election, with a specification of the claims and the species elected. The Examiner further indicated that if the Examiner disagreed with Applicants' second Election, Applicants might obtain another Office Communication indicating a non-responsive response. Regarding Item (F), no other pertinent matters were discussed. Regarding Item (G), the Interview Summary accurately reflects the general outcome of the Interview, i.e., that agreement with respect to the claims was not reached. Item (H) is inapplicable, as a telephone interview was conducted with the Examiner. The Interview Summary also accurately notes the participants in the interview, the date of the interview, and the type of interview.

Consequently, it is respectfully submitted that the Interview Summary completed by the Examiner, and herein supplemented by the Applicants, is now a "complete and proper recording of the substance of [the] interview," according to M.P.E.P. § 713.04, and, therefore, the substance of the December 12, 2002 interview with the Examiner is hereby made of record.

With regard to the telephonic interview conducted with the Examiner's supervisor, John Niebling, the purpose of the interview was to discuss the results of the interview previously conducted with the Examiner. Reviewing the aforementioned requirements of M.P.E.P. § 713.04, it is respectfully submitted that Item (A) is inapplicable, as no exhibit was shown or demonstration conducted during the interview. Regarding Item (B), claims 47-94 were generally discussed. Regarding Item (C), no specific prior art was discussed. The Applicants conducted an interview with

the Supervisor Niebling to explain the given situation and to request that the Examiner identify the claims readable on each species. Regarding Item (D), no proposed amendments of a substantive nature were discussed during the interview, as the Applicants conducted the interview merely to explain the given situation and to request that the Examiner identify the claims readable on each species. Regarding Item (E), the general thrust of the Applicants' argument was that the Examiner should identify the claims readable on each species. Supervisor Niebling's response was a promise to review the facts of the situation and get back to Applicants at a later date with an answer. Regarding Item (F), no other pertinent matters were discussed. Regarding Item (G), the general outcome of the interview was that a telephone message from Supervisor Niebling was eventually left on the voice mail of Applicants' attorney indicating essential agreement with the Examiner's requirement, but indicating that the Applicants were free to call Supervisor Niebling if further information was needed. No subsequent call was made by Applicants. Item (H) is inapplicable, as a telephone interview was conducted with Supervisor Niebling.

Consequently, it is respectfully submitted that the previous discussion is a "complete and proper recording of the substance of [the] interview," according to M.P.E.P. § 713.04, and, therefore, the substance of the interview conducted with Supervisor Niebling is now made of record. No further interviews were conducted with either the Examiner or Supervisor Niebling.

In the third section of the Office Action, claims 47-51 and 53-56 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Greenwald (U.S. Patent No. 5,104,690, hereinafter "Greenwald"). This rejection is respectfully traversed.

The Examiner is correct in that Fig. 3 of Greenwald discloses introducing an organometal gas and an oxidation gas from separate inlets.

In addition, Greenwald discloses, in Column 4, lines 16 to 21, that the total pressure in deposition may be set near atmospheric pressure or 0.01-100 Torr. However, it is disclosed that the pressure of 0.01-100 Torr is chosen only for the configuration of Fig. 1 or 2. It should be noted that the apparatuses shown in Fig. 1 and 2 have one inlet from which both of organometal gas and oxidation gas are introduced. Also, it should be noted that Greenwald discloses that in low pressure operation, a plasma may be induced in the deposition chamber, see column 4, lines 19 to 21.

Thus, Greenwald never discloses the vapor phase growth method which uses separate introduction inlets for introducing the organometal gases and an oxidizing gas into a vacuum chamber, and the total pressure of the vacuum chamber being at 1×10^{-2} Torr or lower during the deposition.

Regarding claim 5 in Greenwald, it is respectfully submitted that the Examiner did not correctly understand it. Part of claim 5 states, "(a) maintaining a CVD reactor at a pressure from about 10^{-6} Torr to 760 Torr, said reactor containing an inert gas." However in step (a), pressure is maintained only by an inert gas. Therefore, the pressure of from about 10^{-6} Torr to 760 Torr is not the pressure during deposition. This can be clearly inferred from the entire process of claim 5.

Thus, before a substrate is placed in the reactor, the pressure in the reactor is set as described in step (a); then the substrate is placed in the reactor in step (b); and then the reaction gases are introduced in the reactor in step (c). The pressure during deposition is apparently determined by the amount of gases in step (c), not by the pressure in step (a). Step (a) in claim 5 simply describes the ordinary procedure by which the reactor is set for appropriate pressure by an inert gas before starting the deposition. In addition, claim 5 is based on example 1, in which the total pressure is at atmospheric pressure during deposition, see column 4, line 65.

Claim 6, which depends on claim 5, clearly describes atmospheric pressure. In short, the description regarding the pressure from about 10^{-6} Torr to 760 Torr in claim 5 is not the pressure during deposition.

In summary, Greenwald never discloses a vapor phase growth method which uses separate introduction inlets for introducing the organometal gases and an oxidizing gas into a vacuum chamber and the total pressure of the vacuum chamber being at 1×10^{-2} Torr or lower during the deposition. In addition, Greenwald never suggests the advantageous effect of the present invention, *i.e.*, in the event that the pressure is 10^{-2} Torr or lower, the orientation of crystallinity and uniformity of surface of the substrate are obtained.

Claim 50 stipulates the use of NO_2 gas as the oxidizing gas, which is not disclosed in the prior art. The advantageous effect of using NO_2 gas as compared with O_2 gas is shown in Fig. 13 and on page 79, line 7, to page 80, line 11, of the specification. Claim 51 stipulates a self-controlling gas supply which is not disclosed in the prior art. The advantageous effect is also described in the specification on, for example, page 41, line 16, to page 42, line 1. Claim 56 stipulates the temperature of the inner wall, which is also not disclosed in the prior art. The advantageous effect is also explained in the specification, *e.g.*, Fig. 23, and page 87, line 22, to page 89, line 8.

Satoh is relevant to claims 61 to 90 of the present invention where the two step deposition process is claimed, and is not relevant to claims 47 to 56. In fact, Satoh merely discloses 5 Torr in Table 1 in the Example and clearly does not suggest the features of claims 47 to 56 of the present invention. Accordingly, only Eguchi will be discussed below.

The Examiner cited Eguchi to show vapor phase growth of a metal oxide layer of ABO_3 under a pressure lower than 400 Torr. However, Eguchi discloses a conventional CVD method in

which carrier gas is used to feed organometal gases, which method is discussed as a conventional method in the present specification. In the CVD method using carrier gas, the partial pressure of carrier gas is predominant in the total pressure and only small portions in the total pressure are occupied by the partial pressures of the organometal gases and oxidizing gas. Therefore, several Torr of total pressure is required for the CVD method using carrier gas. This is because if the total pressure is lower, either the deposition of metal oxide does not take place at all or a practical speed of deposition cannot be achieved.

In fact, Eguchi uses a pressure of 10 Torr or 50 Torr in the examples, and the deposition of an oxide film with pressure lower than that is not disclosed at all. In addition, Eguchi never suggests the advantageous feature of the present invention, *i.e.*, in case the pressure is 10^{-2} Torr or lower, an orientation of crystallinity and uniformity of surface of the substrate are obtained.

Greenwald does not disclose the combination of steps recited in independent claim 52 of the present invention, because Greenwald does not disclose all of the steps recited in claim 52. For example, Greenwald does not disclose a combination of steps including the step of carrying out film formation by introducing the organometal gases and an oxidizing gas into a vacuum chamber through separate introduction inlets while heating the substrate set in the vacuum chamber and keeping the total pressure of the vacuum chamber at 1×10^{-2} Torr or lower, *wherein flow rates of the organometal gases and the oxidizing gas are directly controlled without using a carrier gas to introduce the organometal gases and the oxidizing gas into the vacuum chamber.*

Exemplary embodiments of the present invention are directed to a vapor phase growth method and apparatus to be used for carrying out vapor phase growth of a metal-oxide-type high-dielectric-constant film, a metal oxide ferroelectric film, and further a metal oxide dielectric film

with a perovskite-type crystal structure, generally represented by ABO_3 , to be used for a capacitor and a gate of a semiconductor integrated circuit using raw materials of organometal gases. According to exemplary embodiments, the present invention relates to a vapor phase growth method of a metal oxide dielectric film on a substrate using organometal gases, in which the film formation is carried out by introducing the organometal gases and an oxidizing gas into a vacuum chamber through separate introduction inlets, while heating the substrate set in the vacuum chamber in a condition to keep the substrate temperature at 450°C or lower during the film formation and keeping the total pressure of the vacuum chamber at 1×10^{-2} Torr or lower. Additionally, in the vapor phase growth method according to exemplary embodiments, the flow rates of the organometal and oxidizing gases are directly controlled *without* using a carrier gas to introduce them into the vacuum chamber. The metal oxide dielectric film formed according to exemplary embodiments exhibits excellent orientation and crystalline properties.

Greenwald discloses specific source compounds useful in the chemical vapor deposition (CVD) of ferroelectric thin films. More particularly, Greenwald provides, in combination with a CVD reactor maintained at a predetermined pressure and flushed with an inert gas, and a substrate within the reactor and maintained at a predetermined temperature, a stream of gases useful in the deposition of thin film ferroelectric materials and introduced into the reactor at certain relative ratios. [see Greenwald, column 2, lines 16-23] According to Greenwald, the CVD and/or MOCVD (metal-organic CVD) reactor contains an inert gas, such as argon, helium or nitrogen. [see Greenwald, column 2, lines 26-27 and 65-67] As disclosed by Greenwald, the operation of a gas-mixing system in a CVD reactor is controlled and monitored on a panel. "The panel displays, among others, a flow chart featuring lines and lights to indicate the admission of one or more of the source compounds,

plus an inert gas into a mixing manifold prior to reaching the reactor tube." [Greenwald, column 3, lines 62-66 (emphasis added)]

According to an exemplary embodiment of Greenwald, PZT thin films can be deposited in a CVD reactor at atmospheric pressure in an inert atmosphere of either argon, helium or nitrogen with the addition of various gaseous source compounds and oxidizing gases. In particular, an example is illustrated of a thin-film ferroelectric PZT material deposited in a CVD reactor with deposition properties including "additional argon flow at 4800 sccm, *with argon being used as a carrier gas*" [Greenwald, column 4, lines 64-65 (emphasis added)] According to Greenwald, "[t]he composition of the resultant thin film can be varied *by changing the relative flow rates of the carrier gas.*" [Greenwald, column 5, lines 7-9 (emphasis added)] Consequently, it is respectfully submitted that Greenwald discloses the use of a carrier gas to introduce the various gaseous compounds in to the CVD reactor. Therefore, it is respectfully submitted that Greenwald does not disclose the step of carrying out film formation by introducing the organometal gases and an oxidizing gas into a vacuum chamber through separate introduction inlets while heating the substrate set in the vacuum chamber and keeping the total pressure of the vacuum chamber at 1×10^{-2} Torr or lower, *wherein flow rates of the organometal gases and the oxidizing gas are directly controlled without using a carrier gas to introduce the organometal gases and the oxidizing gas into the vacuum chamber.*

Since Greenwald does not disclose a combination of steps including the step of carrying out film formation by introducing the organometal gases and an oxidizing gas into a vacuum chamber through separate introduction inlets while heating the substrate set in the vacuum chamber and keeping the total pressure of the vacuum chamber at 1×10^{-2} Torr or lower, *wherein flow rates of the*

organometal gases and the oxidizing gas are directly controlled without using a carrier gas to introduce the organometal gases and the oxidizing gas into the vacuum chamber., it is respectfully submitted that Greenwald does not anticipate the subject matter of claim 52.

In the fourth section of the Office Action, claims 47-51, 53-56 and 61-90 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Moise et al. (U.S. Patent No. 6,211,035, hereinafter "Moise") or Satoh et al. (U.S. Patent No. 6,232,167, hereinafter "Satoh") in view of Eguchi et al. (U.S. Patent No. 5,618,761, hereinafter "Eguchi"). This rejection is respectfully traversed.

Applicants respectfully note that the present application is a U.S. national stage application filed in accordance with 35 U.S.C. § 371 of International Application No. PCT/JP99/04145, which has an international filing date of August 2, 1999. The international application properly claims priority to the following priority applications: Japanese Patent Application Nos. 10/219183, 10/219184 and 10/219187, each filed on August 3, 1998. In the present national stage application, in addition to the right of priority to which Applicants are entitled under 35 U.S.C. § 365, the present national stage application includes a claim for priority under 35 U.S.C. § 119(a) to the same Japanese priority applications. According to M.P.E.P. § 1893.03(c), "[i]f the 35 U.S.C. 119(a) and 35 U.S.C. 365(b) priority claim is to an application, the priority of which was properly claimed in the international application, the claim for priority is acknowledged" Since the priority applications were properly claimed in the international application, and since verified English translations of the Japanese priority documents are enclosed, it is respectfully submitted that present U.S. national stage application is entitled to an effective filing date of August 3, 1998, based on the priority date of the aforementioned international and Japanese priority applications.

It is respectfully noted that the filing date of Moise is September 9, 1999. However, Moise claims priority to Provisional Application No. 60/123,687, filed March 10, 1999, Provisional Application No. 60/114,228, filed December 30, 1998, Provisional Application No. 60/099,848, filed September 11, 1998, and Provisional Application No. 60/099,571, filed September 9, 1998. *Even assuming* that all of the claims of Moise are entitled to the filing date of the earliest filed provisional application (i.e., September 9, 1998), even the earliest effective filing date of Moise is *after* the effective filing date of the present application (i.e., August 3, 1998). Therefore, since even the earliest effective filing date of Moise is *after* the effective filing date of the present application, it is respectfully submitted that Moise does not qualify as prior art to the present application, and, therefore, cannot be used, either alone or in combination with any other reference, to reject the claims of the present application.

Present claims 61 to 63 are independent claims and are characterized in that they have a two-step process where initial nuclei or an initial layer is formed under a first film formation condition, then film formation is performed under a second film formation condition. The first film formation conditions differ from each other as follows:

In claim 61, all of the organometal gases to be the raw materials are used and initial nuclei are formed.

In claim 62, all of the organometal gases to be the raw materials are used and an initial layer is formed.

In claim 63, a part of the organometal gases to be the raw materials are used and initial nuclei are formed.

Satoh discloses forming an initial layer as the first step and the film formation is performed in the second step. In contrast, claims 61 and 63 of the present invention stipulate to form "initial nuclei" which is the state before the continuous layer is formed. However, in Satoh, the crystalline thin film is formed in the first step, which is clearly shown in Fig. 1 (numeral 5). By forming initial nuclei, *i.e.*, by prohibiting the deposition under the first condition from proceeding to the stage of a continuous layer, the invention of claims 61 and 63 achieve the advantageous effects that a non-uniformity of electric field and a decrease in spontaneous polarization due to unnecessary boundary formation are effectively prevented.

Regarding claim 62, it has been amended to indicate that the temperature during the formation of the initial layer under the first condition and during the film formation under the second condition is kept constant, that is, the temperature is not changed throughout the growth method. This feature is supported in the present specification by page 43, line 9, to page 50, line 10, where claims 61 and 62 are explained, and, in particular, by page 45, lines 5 to 22, which describes the condition of film formation, in which the conditions such as flow rate for the first 40 seconds and that for the second 600 seconds are changed; however, the temperature is not changed.

In contrast, Satoh discloses a two-step film growth where the substrate temperatures for forming a first crystalline thin film and that for forming a ferroelectric thin film are different from each other, see claim 1 in Satoh. The temperature change of the substrate during the film formation causes a significant loss of time in changing temperature and in waiting until stabilization of the temperature. Thus, the two-step growth of the film described in Satoh is not preferred in an actual process. In contrast, according to the amended claim 62, conditions are changed for the first and the

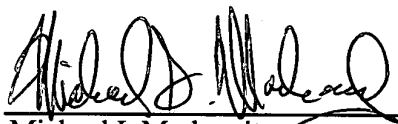
second condition insofar as the amount of feeding gases, etc. is concerned, but temperature is not changed. Thus a loss of time does not occur, and neither does a decrease in productivity.

All of the rejections raised in the Office Action having been addressed, it is respectfully submitted that the present application is in condition for allowance and a notice to that effect is earnestly solicited. Should the Examiner have any questions regarding this response or the application in general, the Examiner is urged to contact the undersigned at (212) 940-8800.

Please charge Deposit Account No. 50-1290 the sum of \$324.00 for three (3) independent claims and four (4) total claims added by this amendment in excess of those covered by the filing fee paid.

Respectfully submitted,
KATTEN MUCHIN ZAVIS ROSENMAN

By:



Michael I. Markowitz
Reg. No. 30,659

Enclosure: Corrected Form PTO-1449
Verified English Translations of Japanese Patent
Application Nos. 219183/1998, 219184/1998, and 219187/1998

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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

Sheet 1 of

Application No. : 09/744,701
Filing Date : January 29, 2001
First Named Inventor: Tori TATSUMI, ET AL.
Group Art Unit : 2812
Examiner Name :
Attorney Docket No. : NECW 18.281(100806-17349)

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No. ¹	U.S. Patent Document	Kind Code if known ²	Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Pages, Columns Lines Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials	Cite No. ¹	Foreign Patent Document Office ³ Number ⁴	Kind Code ⁵ (if known)	Country	Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Pages, Columns Lines Where Relevant Passages or Relevant Figures Appear
		5-21744		JP		01/29/1993	
		9-223673		JP		08/26/1997	
		9-321234		JP		12/12/1997	
		10-12833		JP		01/16/1998	
		10-41486		JP		02/13/1998	

Examiner Signature		Date Considered	
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Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw a line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹Unique citation designation number. ²See attached Kinds of U.S. Patent Documents. ³Enter Office that Issued the document, by the two-letter code (WIPO Standard ST.3). ⁴For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.1⁶ if possible. ⁶Applicant is to place a check mark here if English language Translation is attached.

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